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(71)Applicant : **NIPPON SANZO KK
MITSUBISHI HEAVY IND
LTD**

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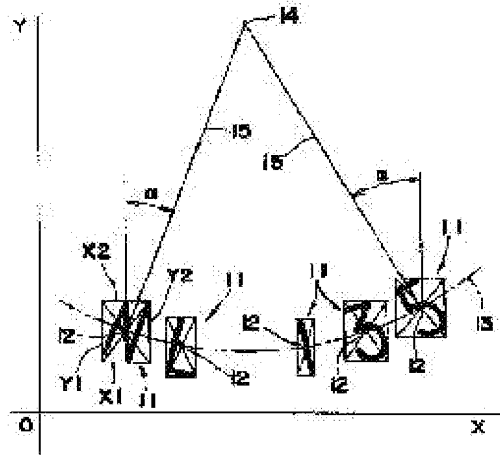
(72)Inventor : **WADA SATOSHI
MATSUDA MICHIHARU
SHIKATA JUNICHIRO
ODA YOSHIMI**

(54) READING METHOD OF SYMBOL STRING SHOWN ON SPHERICAL SURFACE

(57)Abstract:

PURPOSE: To provide a reading method which can surely identify a symbol string shown on a spherical surface such as the number of a high-pressure gas container, etc.

CONSTITUTION: A symbol string shown on a spherical surface approximately in the same latitude is photographed approximately at a normal line position, and each symbol of the string is fetched into the X-Y orthogonal coordinates as the graphic data. Each of these graphic data is enclosed by a straight line that is parallel to the X and Y axes in the form of a circumscribed square 11. Then a center point 14 is calculated for 8 circular arc approximating to a curve is that connects together the centroids 12 of each square 11. Each graphic data is turned around each centroid 12 so that the straight lines 15 connecting the centroids 12 to the point 14 are set in parallel to the Y axis. Then each turned



graphic data is compared with 8 basic pattern and recognized as a symbol.

[Claim(s)]

[Claim 1] In reading a symbol string displayed on the approximately said latitude on a surface of a sphere, said symbol string is photoed from an abbreviated normal position of said surface of a sphere, After incorporating a sign which constitutes said symbol string in X-Y rectangular coordinates as each graphic data, Surround said each graphic data in a straight line respectively parallel to the X-axis and a Y-axis, and a circumscribed quadrangle is formed, Ask for the central point of a circle approximated to a curve which connects a center of figure of each circumscribed quadrangle, and each graphic data are rotated centering on each center of figure so that a straight line which connects a center of figure of each circumscribed quadrangle from this central point may become parallel to a Y-axis, How to read a symbol string displayed on a surface of a sphere characterized by what each obtained graphic data are compared and contrasted with basic pattern, and is recognized as a sign.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the method of reading symbol strings, for example, the receptacle number etc. which are written by the shoulder of the bomb, such as an alphanumeric character displayed in detail on a field similar to a surface of a sphere or a surface of a sphere, about how to read the symbol string displayed on the surface of a sphere.

[0002]

[Description of the Prior Art] After incorporating the displayed sign optically as a method of reading automatically the sign displayed on the surface of various articles and securing from the former as graphic data, performing image processing and identifying each graphic data as signs, such as an alphanumeric character, is performed.

[0003] For example, after an optical-character-recognition device's detecting as a figure each number displayed on space, such as a postcard, and securing graphic data to a memory etc., he carries out image processing of these figures, and is trying to recognize as a number in reading of a zip code.

[0004] Image processing from the figure at this time to a number makes some basic pattern memorize every number of 0 to 9 beforehand, By repeating processing in which it eliminates if you carry out scaling of the graphic data read optically suitably, for example, you make it pile each other up, and it compares and contrasts with said basic

pattern by law etc., and in agreement, it is made into an answer and it is not in agreement, Each graphic data were identified as a number and it recognizes as a zip code. Reading of the number plate of a car, etc. is performed similarly.

[0005]

[Problem(s) to be Solved by the Invention]However, in the conventional method, although the symbol string on a flat surface was able to be identified to abbreviated accuracy, it was not able to identify the symbol string displayed on the surface of a sphere, for example, the receptacle number etc. which are stamped on the shoulder of the bomb. When this reason reads the symbol string displayed on the surface of a sphere with optical-character-recognition devices, such as a television camera, it is because a symbol string is distorted and is photoed under the influence of a surface of a sphere.

[0006]For example, the receptacle number of the above-mentioned bomb is stamped so that it may come to the approximately said latitude of the surface of a sphere which forms the same height of the shoulder of a container when it stood and places, i.e., the shoulder of a container. For this reason, if a receptacle number is photoed with the television camera 2 from the horizontal direction of the bomb 1 stood and placed as a fictitious outline shows to drawing 1, as shown in drawing 2, under the influence of a surface of a sphere, the character of the both ends of a symbol string will incline more greatly, and it will be distorted and reflected. As a solid line shows to drawing 1, when a photograph is taken with the television camera 2 from the normal line direction of the surface of a sphere of a shoulder, as shown in drawing 3, the symbol string 3 will be ranked with a sector. In this case, although the distortion of a sign becomes small compared with what was photoed from the horizontal direction one by one, the grade of inclination of the character of both ends is comparable as what was photoed from the horizontal direction.

[0007]Therefore, since the sign which inclined greatly and was read is not in agreement with the basic pattern of the sign beforehand stored in the reader if the above image data tends to be processed by the conventional method and it is going to identify a symbol string, the sign of the both ends of a symbol string can be identified.

[0008]Since it was such, even if the receptacle number of the bomb could not be made to read automatically but it was going to automate management of the bomb at the gas-charging factory etc., it had to depend for reading of a receptacle number on a worker's viewing. For this reason, there is inconvenience that productivity falls by a worker's reading errors, and it had become the worker's burden.

[0009]Then, an object of this invention is to provide the method of reading that the symbol string displayed on the portion of sphere form is certainly discriminable like the receptacle number of a bomb.

[0010]

[Means for Solving the Problem]How to read a symbol string displayed on a surface of a sphere of this invention in order to attain the above-mentioned purpose, A symbol string displayed on the approximately said latitude on a surface of a sphere is photoed from an abbreviated normal position of said surface of a sphere, After incorporating a sign which constitutes said symbol string in X-Y rectangular coordinates as each graphic data, Surround said each graphic data in a straight line respectively parallel to the X-axis and a Y-axis, and a circumscribed quadrangle is formed, Ask for the central point of a circle approximated to a curve which connects a center of figure of each circumscribed quadrangle, and each graphic data are rotated centering on each center of figure so that a

straight line which connects a center of figure of each circumscribed quadrangle from this central point may become parallel to a Y-axis, It is characterized by what each obtained graphic data are compared and contrasted with basic pattern, and is recognized as a sign. [0011]A surface of a sphere as used in the field of this invention does not point out only a perfect surface of a sphere, and various fields approximated to a surface of a sphere, such as a curved surface which consists of a solid of revolution of curves, such as a thing near a surface of a sphere, [the shape of an ellipse, parabolic], like a shoulder of said bomb, are included.

[0012]

[work --] for If a symbol string is photoed from an abbreviated normal position on a surface of a sphere, a symbol string will be secured as graphic data located in a line with a sector, It will be located on a curve approximated to a circle centering on a certain point of connecting a center of figure of each circumscribed quadrangle obtained by surrounding each figure of graphic data located in a line with a sector in a straight line parallel to the X-axis and a Y-axis, and forming a circumscribed quadrangle.

[0013]Next, since it will become an erection line of each figure if a straight line which connects the central point of a circle approximated to the above-mentioned curve and a center of figure of each circumscribed quadrangle is drawn, If each graphic data are rotated around a center of figure so that these straight lines may become parallel to said Y-axis, each graphic data will be in an erecting state, and reading of them by image processing will become possible by this.

[0014]

[Example]Hereafter, this invention is explained still in detail, referring to drawings. First, the receptacle number (this example "NL 135") 3 stamped on the approximately said latitude of the sphere form portion which forms the shoulder of the bomb 1 in drawing 1 as a solid line shows, A photograph is taken with the television camera 2 from the normal line direction of this surface of a sphere, and as shown the image in drawing 3, while projecting on the monitor TV 4, it incorporates into the reader 5 and image processing is performed.

[0015]As for the television camera 2, it is preferred to set up so that the center section of the receptacle number 3 may come on the center line of the lengthwise direction of a screen. Although the bomb 1 may be settled on the prescribed position, it may be during movement currently conveyed on the cart or the band conveyor.

[0016]Not only the alphanumeric character that constitutes the receptacle number 3 but the sign showing the kind of gas with which this bomb 1 is filled up is contained in receptacle number 3 portion of the bomb 1 (N₂ which shows that it is a container for nitrogen filling in the case of this example is stamped). The color the outer wall of the bomb 1 was colored, and a different color are applied to the portion on which the receptacle number 3 was stamped.

It can identify now easily not only with viewing but with the television camera 2.

[0017]Thus, the read graphic data of a symbol string are processed in the procedure shown below, and are recognized as a sign. First, since it is not necessary to read the sign according to the above-mentioned type of gas when reading the receptacle number 3, image processing extracts only the cascade number 3 in a sector.

[0018]As mentioned above, it will be in the state located in a line with the sector, and if

the symbol string of the receptacle number 3 extracted by image processing is photoed with the television camera 2 from the normal line direction of the surface of a sphere of this shoulder, after the sign of the both ends of a symbol string has inclined more greatly, it will be read from the relation stamped on the latitude of the surface of a sphere of the shoulder of the bomb 1.

[0019]Thus, the read symbol string is incorporated in the X-Y rectangular coordinates shown in drawing 4, and first, while surrounding the graphic data of each sign by the four straight lines X1 parallel to the X-axis and a Y-axis, X2, Y1, and Y2 and forming the circumscribed quadrangle 11 for every graphic data, the center of figure 12 of each circumscribed quadrangle 11 is searched for.

[0020]Next, if the center of figure 12 of each graphic data is connected, it will become the curve 13, but this curve 13 can be made to approximate with the least square method to a part of circle (circle) centering on a certain point. Therefore, since it can assume that the center of figure 12 of each graphic data exists on the circle of the approximated circle, it asks for the central point 14 of this circle on X-Y rectangular coordinates.

[0021]And the center of figure 12 and the central point 14 of each graphic data are connected with the straight line 15, and it asks for the intersecting angles alpha of this straight line 15 and a Y-axis, and each graphic data are rotated by angle alpha centering on the center of figure 12 so that the straight line 15 which connected the center of figure 12 and the central point 14 may become parallel to a Y-axis.

[0022]Since each graphic data will be in an erecting state as shown in drawing 5 by this operation, collation with some basic pattern of the sign beforehand memorized by the reader 5 is attained, and each graphic data can recognize, respectively.

[0023]The symbol string stamped on the shoulder of the bomb 1 can be read as a receptacle number original with a container by this, The bomb 1 is manageable by incorporating management data, such as manufacture years for every container beforehand accumulated in the database, a serial number, a filler gas name, weight, and arrangement destinations, from the read receptacle number.

[0024]The graphic data read in parallel as shown in said drawing 2, The sign of both ends not only leans, but since it had changed into the state where it was distorted and the graphic data 3a and 3a of the both ends of the graphic data 3 have been distorted as shown in drawing 6 even when it processes like the above, collation with basic pattern is difficult and it cannot recognize as a sign.

[0025]Although reading of the symbol string which expresses with this example the receptacle number stamped on the bomb was explained, this invention method cannot be restricted to this and can be applied also to reading of the variety of information which consists of a symbol string indicated to the approximately said latitude of the field where other articles were similar to a surface of a sphere or this.

[0026]

[Effect of the Invention]Since the symbol string displayed on the surface of a sphere, for example, the receptacle number etc. which were stamped on the shoulder of the bomb, can be read automatically and correctly according to this invention method as explained above, A bomb etc. can be managed certainly and easily, and a worker's burden can be eased substantially, and improvement in productivity can also be aimed at.